

L Number	Hits	Search Text	DB	Time stamp
1	5	((("6241760") or ("5954743") or ("6152957") or ("5922021"))).PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 08:56
2	3	((("6241760") or ("5954743") or ("6152957") or ("5922021"))).PN.) and taper\$.clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 07:54
3	1502	((606/198) or (623/1.16,1.17,23.7,1.13)).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 09:44
4	680	(623/1.15,1.3,1.31).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 09:28
5	67	(623/1.3,1.31).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 09:28
6	630	(623/1.15).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 10:20
7	2	("5716393"   "5749919").PN.	USPAT	2003/04/02 09:53
8	14	("5102417"   "5449373"   "5591197"   "5669932"   "5697971"   "5776161"   "5776183"   "5800521"   "5800526"   "5807404"   "5810872"   "5824043"   "5836964"   "5843120").PN.	USPAT	2003/04/02 09:58
9	13	("4743251"   "5064435"   "5383892"   "5449373"   "5575818"   "5683411"   "5693086"   "5725549"   "5741333"   "5755769"   "5800508"   "5800514"   "5824059").PN.	USPAT	2003/04/02 10:05
10	547	(taper or tapered or tapering) and stent and strut	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 10:21
11	80	(taper or tapered or tapering) same stent same strut	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/04/02 10:21

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3	US 5907893		USP:19990601	30	N
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5	US 5776583		USP:19980707	7	F
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10	US 5354308		USP:19941011	10	N
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24					



US 6,348,065 B1

# (12) **United States Patent** Brown et al.

(10) Patent No.: **US 6,348,065 B1**  
(45) Date of Patent: **\*Feb. 19, 2002**

## (54) **LONGITUDINALLY FLEXIBLE EXPANDABLE STENT**

(73) Inventors: Brian J. Brown, Hancock; Michael L. Davis, Shorewood, both of MN (US)  
(72) Assignee: Schmed Life Systems, Inc., Maple Grove, MN (US)

(\*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).  
Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/712,431

(22) Filed: Jul. 24, 1998

### Related U.S. Application Data

(63) Continuation of application No. 08/511,075, filed on Aug. 3, 1995, which is a continuation-in-part of application No. 08/596,569, filed on Mar. 1, 1995, now abandoned.

(51) Int. Cl. A61F 2/06

(52) U.S. Cl. 639/1.14; 606/198; 623/1.19

(58) Field of Search 623/1.15, 1.16, 623/1.17, 1.18, 1.19; 606/195, 198

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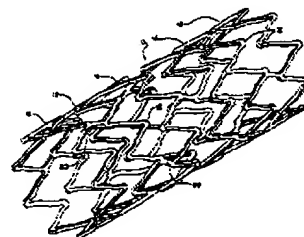
Primary Examiner—Paul B. Prohlik

(74) Attorney, Agent, or Firm—Vidya, Annet & Seidman

### (57) ABSTRACT

The invention provides a tubular expandable stent including a plurality of cylindrically shaped open cylindrical segments aligned on a common longitudinal axis to define a generally tubular stent body, each segment being defined by a member formed in an undulating flexible pattern of interconnected subunits by parallel struts with pairs thereof having alternating interconnecting end portions to define the periphery of the expandable stent segment, and in which the connected end portions of paired struts in each segment, before the stent is expanded, are positioned substantially opposite to connected end portions of paired struts in adjacent segments.

45 Claims, 3 Drawing Sheets



US-PAT-NO: 5853419  
DOCUMENT-IDENTIFIER: US 5853419 A  
TITLE: Stent

----- KWIC -----

Another embodiment of the invention is shown in FIG. 7 which shows a portion of a stent 61 having struts 62 spaced apart longitudinally of the axis of the stent and adjoining longitudinally extending circumferentially spaced apart ribs 63. The struts 62 rather than being of all of the same length as in the previous embodiments hereinbefore described have differing lengths. Thus as shown in FIG. 7, the strut 62 immediately adjacent the left end of the stent 61 as shown in FIG. 7 is longer than the other struts. This makes it possible when the stent 61 is expanded as shown in FIG. 8 to have one end, the end adjacent the longer strut 62 to be flared outwardly as shown and to taper inwardly gradually to a smaller diameter. This flaring on one end may be desirable in certain applications in which it is desirable that the stent more securely grasp the vessel, as for example a carotid artery, in which it is

disposed to prevent longitudinal movement of the stent after the stent has been deployed. This additional expansion at one end can be readily achieved merely by expansion of the balloon used for expanding the stent. Similarly, if it is desired to have flared ends at both ends of the stent as shown in FIG. 9, this can be readily accommodated by providing a stent 71 having struts 72 spaced apart longitudinally of the axis and between longitudinally extending circumferentially spaced apart ribs 73 as shown in FIG. 9. To accomplish this it is merely necessary to provide struts 72 at opposite ends having greater lengths than the struts therebetween to achieve flanged portions at both ends of the stent to aid in again assuring that the stent will firmly grasp the walls of the vessel in which it is placed and will be retained in that location. Such a stent can also be deployed in a conventional manner by the use of a balloon or by providing a self-expanding stent.

US-PAT-NO: 5853419  
DOCUMENT-IDENTIFIER: US 5853419 A  
TITLE: Stent

----- KWIC -----

Another embodiment of the invention is shown in FIG. 7 which shows a portion of a stent 61 having struts 62 spaced apart longitudinally of the axis of the stent and adjoining longitudinally extending circumferentially spaced apart ribs 63. The struts 62 rather than being of all of the same length as in the previous embodiments hereinbefore described have differing lengths. Thus as shown in FIG. 7, the strut 62 immediately adjacent the left end of the stent 61 as shown in FIG. 7 is longer than the other struts. This makes it possible when the stent 61 is expanded as shown in FIG. 8 to have one end, the end adjacent the longer strut 62 to be flared outwardly as shown and to taper inwardly gradually to a smaller diameter. This flaring on one end may be desirable in certain applications in which it is desirable that the stent more securely grasp the vessel, as for example a carotid artery, in which it is

disposed to prevent longitudinal movement of the stent after the stent has been deployed. This additional expansion at one end can be readily achieved merely by expansion of the balloon used for expanding the stent. Similarly, if it is desired to have flared ends at both ends of the stent as shown in FIG. 9, this can be readily accommodated by providing a stent 71 having struts 72 spaced apart longitudinally of the axis and between longitudinally extending circumferentially spaced apart ribs 73 as shown in FIG. 9. To accomplish this it is merely necessary to provide struts 72 at opposite ends having greater lengths than the struts therebetween to achieve flanged portions at both ends of the stent to aid in again assuring that the stent will firmly grasp the walls of the vessel in which it is placed and will be retained in that location. Such a stent can also be deployed in a conventional manner by the use of a balloon or by providing a self-expanding stent.

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77	US 5755771	USP	19980526	10	E
78	US 5766710	USP	19980616	12	B
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# United States Patent [19]

## Kanesaka et al.

[11] Patent Number: 5,776,183  
[45] Date of Patent: Jul. 7, 1998

### [54] EXPANDABLE STENT

[76] Inventors: Noriomi Kanesaka, 36 Cathy Rd.;  
George A. Thalh, 24 Cathy Rd., both  
of Hillsdale, N.J. 07642

[21] Appl. No.: 702,167

[22] Filed: Aug. 23, 1996

[31] Int. Cl. A61F 2/06

[32] U.S. Cl. 623/1; 623/12; 623/11;  
606/194; 606/195; 606/198

[58] Field of Search 623/1, 11, 12;  
606/194-200, 157-158; 600/36

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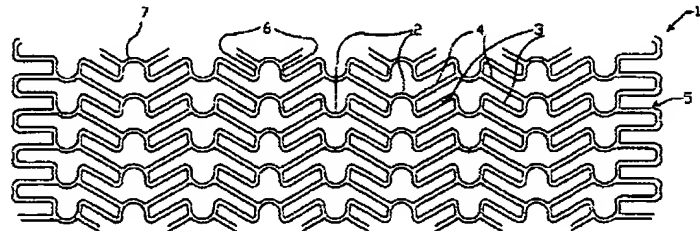
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Primary Examiner—John G. Weiss  
Assistant Examiner—Francis K. Cuddihy  
Attorney, Agent, or Firm—Kanesaka & Takazuchi

### [57] ABSTRACT

An expandable tubular reinforcing member of the invention is used for a body lumen. The reinforcing member is basically formed of a plurality of rows of expandable joint members and a plurality of rows of flexible elongated members. The joint members in one row are arranged in a circular form and are spaced apart from each other. The elongated members in one row are arranged in a circular form, and each flexible elongated member extends diagonally to a central axis of the reinforcing member and connects two of the joint members situated in adjacent two rows. When a radial force is applied from an inside of the reinforcing member, the elongated members are bent relative to the joint members to have a larger diameter.

18 Claims, 2 Drawing Sheets



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22	US RE34327			USP:19930727	5	I	
23	US 5269802			USP:19931214	8	P	
	US 5354308			USP:19941011	20	H	
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26	US 5382259			USP:19950117	15	V	
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31	US 5411549			USP:19950502	7	S	
32	US 5441515			USP:19950815	20	R	
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41	US 5591227			USP:19970107	14	D	

United States Patent [19]  
Simon et al.

[11] Patent Number: 5,354,308  
[45] Date of Patent: Oct. 11, 1994

[34] METAL WIRE STENT

[75] Inventors: Morris Simon, Boston; Dmitry J. Rabkin, Brookline; Stephen Khoshdel, Scituate, all of Mass.

[73] Assignee: Beth Israel Hospital Association, Boston, Mass.

[21] Appl. No.: 878,184

[22] Filed: May 1, 1992

[51] Int. Cl. .... A61M 29/08

[52] U.S. Cl. .... 606/198; 623/12; 623/1

[58] Field of Search .... 623/1, 12; 606/191, 606/192, 198

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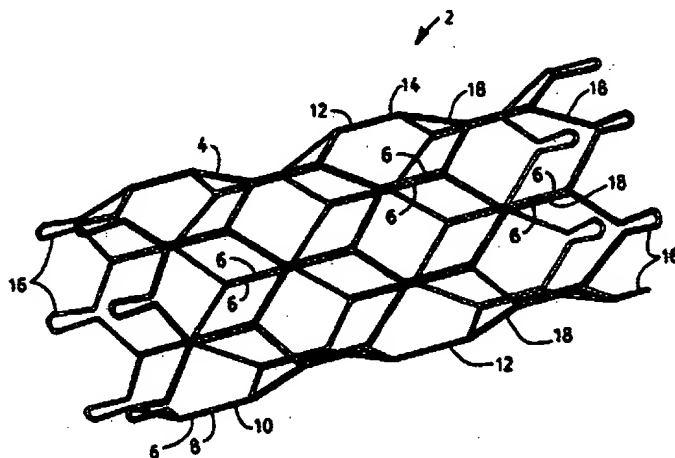
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Primary Examiner—Jerome L. Kruter  
Attorney, Agent, or Firm—Lorusso & Lond

[57] ABSTRACT

A stent comprising a wire skeletal frame, the frame being adapted to assume a first condition in which the frame is relatively rigid and substantially tubular in configuration and a second condition in which the frame is flexible, of reduced stress, and collapsible, such that in the second condition walls of the frame are adapted to be positioned against each other to form a stent diameter substantially equal to the combined thickness of the frame walls in abutting engagement with each other, the frame in its second condition being substantially devoid of bias therein urging the frame to assume the first configuration.

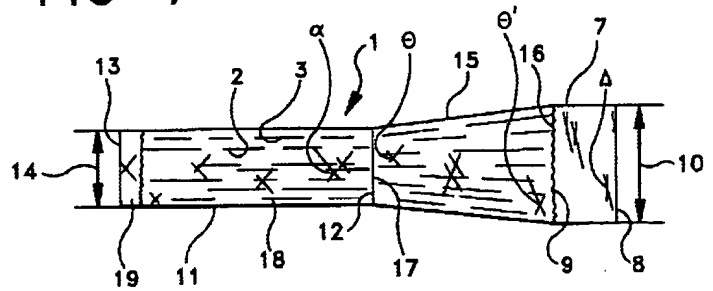
11 Claims, 5 Drawing Sheets





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FIG-7



	Document I	K Sou	Issue-De	Page	*
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(13) United States Patent  
Killion et al.

(10) Patent No.: 6,403,202 B2  
(45) Date of Patent: Nov. 26, 2002

(54) STENT HAVING VARIABLE PROPERTIES  
AND METHOD OF ITS USE

(75) Inventors: Douglas P. Killion, Maple Grove, MN  
(US); James R. Lhinger, New Hope,  
MN (US)

(73) Assignee: SciMed Life Systems, Inc., Maple  
Grove, MN (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 9 days.

This patent is subject to a terminal dis-  
claimer.

(21) Appl. No.: 09/735,388

(22) Filed: Dec. 12, 2000

(65) Prior Publication Data

US 2001/0004705 A1 Jun. 21, 2001

#### Related U.S. Application Data

(60) Continuation of application No. 09/314,656, filed on May  
19, 1999, now Pat. No. 6,159,238, which is a division of  
application No. 09/034,249, filed on Mar. 4, 1998, now Pat.  
No. 5,938,697.

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(58) Field of Search ..... 623/1.15, 1.16,  
623/1.17, 1.2, 1.3, 1.31

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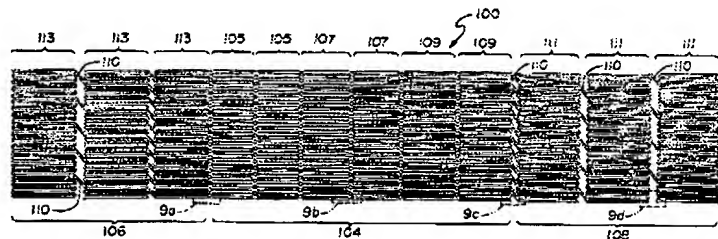
Assistant Examiner—Suzette J. Jackson

(74) Attorney, Agent, or Firm—Vidas, Arrett & Steinkraus

(57) ABSTRACT

A stent and method of its use, the stent is in its expanded  
configuration, exhibiting varying outward radial force along  
its length. In use, the expanded stent is of a tapered con-  
figuration which provides greater force in vessel regions  
requiring greater force and less force in regions requiring  
less. In particular the stent is useful in the ostium regions and  
at areas of bifurcation in vessels. Varying force over the  
length of the stent is achieved by varying the number of  
elements, the density of elements, the thickness of the  
elements making up the stent body, and maintaining a  
substantially metal to artery ratio in the expanded stent over  
its length.

20 Claims, 5 Drawing Sheets





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[75] Inventor: Anthony C. Lunn, Princeton, N.J.

Primary Examiner—David H. Willsie  
Assistant Examiner—Bruce E. Snow  
Attorney Agent, or Firm—Paul A. Colanti

[73] Assignee: Ethicon, Inc., Somerville, N.J.

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[58] Field of Search 623/1, 12, 9; 606/192, 606/194, 195, 197

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## ABSTRACT

This invention relates to a graft for placement in a body passageway. The graft comprises a longitudinally extending thin walled cylinder having first and second open ends. The graft is divided into first and second axially extending end portions adjacent such open ends and an axially extending central portion therebetween. The walls of the central portion are provided with circumferential crimps and the wall of the end portions are provided with axially extending crimps whereby the central portion can be extended longitudinally to vary the distance between the end portions and the end portions may be expanded radially to vary the diameter of the end portions. In preferred embodiment the end portions have a greater diameter than the central portion imparting to the graft a somewhat dumbbell like shape preferable in employing the graft in the reduced diameter lumen of a diseased blood vessel.

21 Claims, 4 Drawing Sheets

